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ENVIRONMENTAL INFLUENCES IN THE AGRICULTURE OF ANCIENT EGYPT

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Aside from the climatic conditions of heat and cold, the two great factors which determine the agricultural possibilities of any country are moisture and fertility of soil. The last-mentioned factor is fourfold and includes the presence in the soil of the various elements of plant food, their availability, the physical condition of the soil, and its freedom from toxic substances. To the degree in which these conditions exist in combination with suitable temperature is a country naturally productive. Any deficiency must be made up by additional work or expense if the land is to yield largely. A country which is agriculturally fit has an enormous advantage, inasmuch as it possesses at once a firm basis upon which national prosperity may be developed.

Agriculture is the earliest form of regular occupation undertaken by nomad tribes when they forsake their wandering life and settle down to more or less fixed abiding places. At first, methods and implements are crude, and results are meager. As the stationary population increases, however, the demand for food becomes greater and more attention is given to its production. The larger yield

which follows results again in increased efforts on the part of man, and finally in the realization that agriculture may be the very foundation of national independence. The ability to feed, not only one's self, but also one's neighbors in their times of need is a large asset for any nation, and one which has been a determining factor in many of the colonizing schemes of history.

That Egypt gained national prosperity so early and in so great a degree was due in large measure to the products of her fields. Biblical accounts¹ and early inscriptions both show that Egypt was a land of plenty, and one to which her famine-stricken neighbors frequently turned for sustenance. Such agricultural pre-eminence was made possible by the Nile, whose annual inundations brought to the land both its water and its fertile alluvium.

Ancient Egypt—the Nile Valley below the First Cataract—lay in the great desert belt which (except where broken by local conditions) encircles the globe 25°–35° north of the thermal equator. In this belt of high pressure the principal movement of the air is downward and, as a result, except where local disturbances cause local upward air currents, there is no rainfall. Egypt is thus normally a part of the same desert as the Sahara on the west and the Arabian Desert on the east. Only the Nile saves it from the same fate. Thus it is that the yearly flood has always been the most important event in all Egypt. The water begins to rise at the First Cataract early in June, and from that time the flood rapidly and steadily increases in volume until the latter part of September. After a period of three or four weeks, during which it remains nearly stationary, a further rise occurs, and the maximum is reached early in November. It is then about fifty feet higher at the First Cataract than in time of low water and twenty-five feet at Cairo. From that time it steadily subsides until by the end of March the fields have gradually dried up, and for the rest of the year—until June—the river is at its lowest stage.

Explanation of the phenomenon of the flood is to be found, not in Egypt itself, but rather in conditions at the headwaters of the Nile, in the highlands of Abyssinia, where the Blue Nile and the Atbara have their sources, and in the equatorial lake region of British

¹ Gen. 12:10; 26:1, 2; 41:57.

East Africa.¹ Abyssinia lies near the northern limit of the belt of equatorial calms, a zone in which there is heavy daily rainfall, but one which shifts from north to south, and back, with the movement of the thermal equator, causing 90 per cent of the year's precipitation to occur between June 1 and October 1.² The surface of the table land is extremely rugged and broken, with mesas and peaks that rise to a height of ten to fifteen thousand feet above sea-level; the run-off following a rain is consequently very rapid, and the driest gullies are suddenly transformed into beds of surging torrents. For the four months beginning with June, Abyssinia is thus converted into a network of torrential streams, and during the rest of the year the land is dry and parched. The Atbara frequently dries up entirely and the Blue Nile is reduced to insignificance.³ During the rainy season it is these two streams which supply the volume of the Nile, and the amount and velocity of the flood are thus dependent upon the character of the seasonal rainfall in the Abyssinian highlands.⁴ Any variations from the normal precipitation, in amount or in time, are recorded in the height of the flood, and later in the Egyptian harvest.

The White Nile, although longer than the Blue Nile and Atbara combined, and having an annual discharge three times as great as the former, is a relatively unimportant factor in the inundation. Instead, it may be said to furnish the supply during the rest of the year when the Lower Nile otherwise would be dry. This is due largely to the fact that, because of the configuration of the country through which it flows, its fall is not continuous, but is interrupted by long level reaches where the stream tends to spread out in time of high water, reducing the volume to be carried on.⁵ Lakes and swamps abound on these reaches and aid in retarding the stream still further. Near its junction with the Blue Nile its gradient is so low that the waters of the latter in rising pond back those of the White Nile, and during

¹ See report by H. G. Lyons, "Some Geographic Aspects of the Nile," *Smithsonian Institution Report*, 1901, Part I, pp. 483 ff.

² *Ibid.*, p. 487.

³ S. W. Baker, *The Nile Tributaries of Abyssinia* (London and New York, 1871), p. ix.

⁴ "The equatorial lakes feed Egypt, but the Abyssinian rivers cause the inundation." —Baker, p. ix.

⁵ Lyons, *op. cit.*, p. 484.

the height of the flood effectually prevent them from passing forward.¹ By spreading out over their valley, however, they form a reserve supply which drains off as the flood begins to subside. The amount of water which is thus conserved for the later supply of the river is consequently dependent to some extent upon the height of the Blue Nile flood—that is, upon the rains in Abyssinia. The regulation of the Lower Nile by the White is simplified by the fact that British East Africa is situated so as to have two rainy seasons instead of one, as a result of the shifting of the doldrums. Its comparatively level surface, with its heavy forests and rank grasses and its lakes and marshes, prevents the rainfall from running off rapidly and enables the region to give it up regularly and gradually.

The White Nile carries little sediment, however, as most of its load is lost during its passage through lakes and swamps, or is deposited in its own level reaches long before it joins with the Blue Nile. The Abyssinian tributaries, on the contrary, especially the Atbara, are laden with a fine reddish-brown silt, and they are the ones which furnish the wonderfully rich alluvium to Egypt.² Its deposit is rendered certain by the low gradient of the Lower Nile, and its amount is indicated by the volume of the turbid flood which bears it.

The silt is largely made up of tiny, undecomposed, crystalline rock fragments mixed with vegetable matter from the Abyssinian highlands. The latter in decomposing releases the imprisoned plant food as it is needed by the growing vegetation. A soil derived in this way is granular and does not puddle easily. As soon as the water recedes it is possible for the laborer to walk across the soil, dropping seeds as he goes,³ without destroying its tilth. Few implements are needed, and often none at all, in preparing the seed bed. The crudest sort of a wooden hoe composed of two strips of wood, one slightly curved, held together by a cord or leather thong, was all that the ancient Egyptians used. A later development was the plow, which was simply a larger wooden hoe, drawn by men or oxen. Representations of both forms are to be found in the paintings on

¹ Lyons, *op. cit.*, p. 487.

² Baedeker, *Egypt*, p. lxii.

³ For representation of broadcast sowing see "Tomb of Paheri" (J. J. Taylor), *Egyptian Exploration Fund*, Plate IV.

the walls of many of the ancient tombs. The tomb of Ti,¹ for instance, which dates from the Fifth Dynasty, and that of Paheri,² from the Eighteenth, show them in use. The attitudes of the men using them reflect the extreme mellowness of the ground, and the consequent ease with which these operations were performed.

The granular character of the soil is of special importance because the descending air in the belt of tropical calms not only yields little or no rain, but actually absorbs such moisture as may be present in the atmosphere. Capillarity is not easily established in a granular soil, and the loss of soil water by the drying winds is thus at a minimum. Even then it is very considerable, and constant irrigation is necessary for the production of crops.

The control of the flood water and its fullest utilization have been, throughout her history, the most important questions which Egypt has had to solve, and among the most far-reaching in effect, not only upon the agricultural resources of the country, but also upon the intellectual and social development of her people. In the remote past they occupied the attention of the predynastic kings, and the recent completion of the great Assuan dam is testimony to the importance with which they are regarded by the engineers of

today.³ ,⁴ one of the signs for the word "nome,"

represents a canal-divided field and furnishes evidence of a rather general system of irrigation at a very early day, probably before the union of the North and South. A wall painting dating from the First and Second dynasties depicts the king breaking ground for a new irrigation canal.⁵ It is of interest to note that he is using a wooden hoe for the purpose. From the same period we have record of the appointment of a "Manager of the Inundation" as a regular government official.⁶ Such centralized control of the flood was essential, for only in that way could there be developed the vast

¹ Steindorf, *Das Grab des Ti*, Plate CXI.

² "The Tomb of Paheri," *op. cit.*, Plate IV.

³ For account of recent efforts at flood controls see Sidney Low, *Egypt in Transition* (London, 1914), pp. 129-39.

⁴ Pyr. (ed. Sethe), 126c, 2152a.

⁵ Breasted, *History of Egypt* (New York, 1905), Fig. 18.

⁶ James Blaikie, *The Story of the Pharaohs* (London, 1908), p. 21.

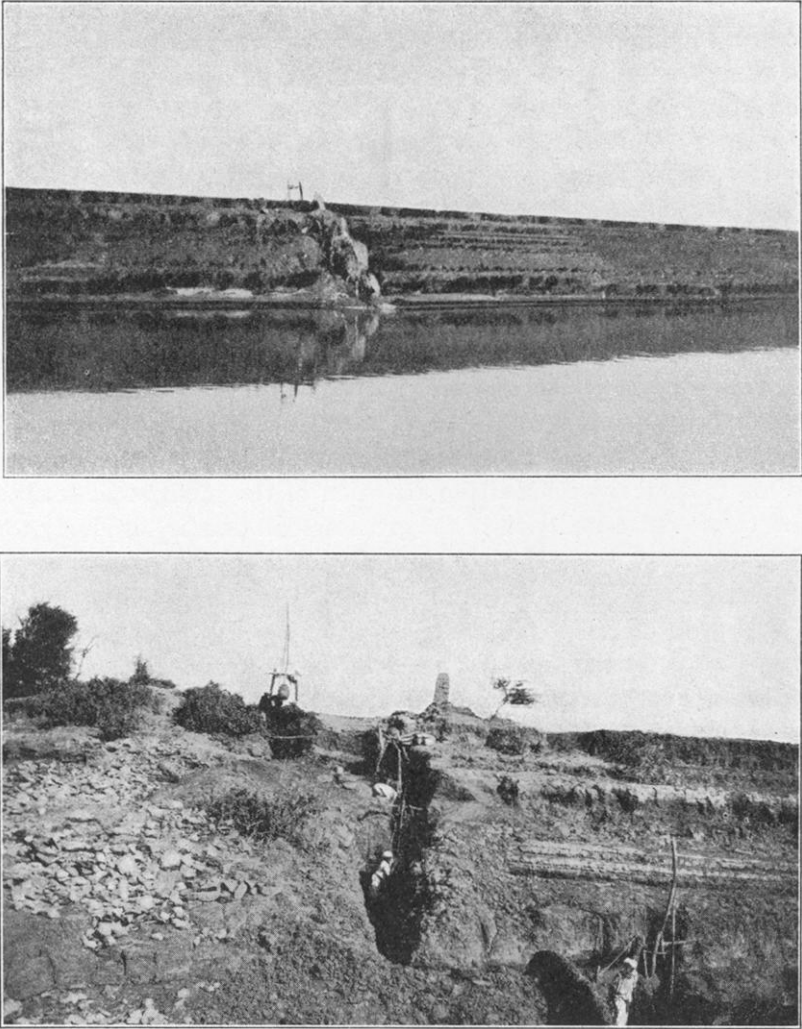


FIG. 1.—Shadufs near Kom Ombo

(Courtesy of Louise Pettibone Smith)

system of canals and dikes necessary for the proper utilization of the water. The inscription of King Kheti II at Suit discloses his activities in that line:

I brought a gift for the city. . . . I substituted a channel of 10 cubits. I excavated for it upon arable land. I equipped a gate. . . . I sustained the life of the city. . . . I supplied water in the highland district. I made a water supply for this city of middle Egypt in the mountain, which had not seen water. . . . I made the elevated land a swamp. I caused the water of the Nile to flood over the ancient landmarks. . . . I made the arable land . . . water. Every neighbor was supplied with water and every citizen had Nile water to his heart's desire. I gave water to his neighbors and he was content with them.¹

Continual watchfulness and constant labor and care were needed in order to maintain these works. Otherwise the canals would quickly silt up and become useless, or the levees would be washed away by the pressure of the water. Thus, in the Twenty-first Dynasty King Nesubenabded, according to the Gebelin inscription, "sat in the hall of his palace, when there came messengers informing his majesty that the canal-wall, forming the limits of Luxor . . . had begun to fall in ruin—forming a great flood and a powerful current therein, on the great pavement of the house of the temple."² Nothing less than concerted action under the direction of a central authority would suffice under such conditions. Since Egypt was primarily an agricultural country, the measure in which this authority was maintained was the measure of the prosperity of the nation. Every lapse in governmental efficiency thus bespoke a corresponding diminution of economic wealth.³ In times of breaking dynasties, when there was no strong authority, the canals fell into disuse, and hard times for the people followed. The Twenty-second Dynasty, for example, was one of declining fortunes, and from it has come the following account: "The flood came on, in this whole land; it invaded the two shores as in the beginning. This land was in his power like the sea, there was no dike of the people to withstand its fury. All the people were like birds upon its . . . tempest . . .

¹ Breasted, *Ancient Records of Egypt*, I, § 407.

² *Ibid.*, p. 308.

³ See Ellen C. Semple, *Influences of Geographic Environment* (New York, 1911), pp. 328-29.

his suspended like the heavens. All the temples of Thebes were like marshes."¹

With the subsidence of the flood, the canals which had to some extent controlled and directed its course became simple irrigation ditches, and the water was raised from them by artificial means. The "shaduf," a leather bucket suspended from one end of a long pole mounted as a sweep, was most often used. Because of the limited distance through which water could be lifted by such a device it was often necessary to use three or four shadufs, one above the other, in order to reach the level of the field. That such a process involved an enormous amount of hard continuous labor is indicated by Breasted's statement that a single crop requires the lifting of 1,600 to 2,000 tons of water per acre within the space of a hundred days.² Deuteronomy 11:10 suggests the wearisomeness of this unrelenting toil: "For the land, whither ye go in to possess it, is not as the land of Egypt, from whence ye came out, where thou sowedst thy seed and wateredst it with thy foot as a garden of herbs." This constant need of low-grade labor must have tended to create and maintain a distinct class of serfs or peasants more or less tied to the soil, and these, in connection with the enormous economic wealth resulting from the abundant harvests, undoubtedly furthered the development of feudalism.

The dependence on the water supply is reflected in the shape of the land holdings, which were long and narrow (1 cubit by 100 cubits being the unit), so that, as nearly as possible, all might have direct access to the canal which served them.³

The flood annually obliterated all boundary lines, and each year the land had to be surveyed or measured anew. For the purpose a long cord or rope having knots at intervals was used.⁴ This remeasurement undoubtedly gave rise to misunderstandings and disputes⁵ and resulted in the formation of a legal land-code.

¹ Breasted, *Ancient Records of Egypt*, IV, § 743.

² Breasted, *History of Egypt*, p. 191.

³ Lyons, *op. cit.*, p. 499.

⁴ See picture in tomb of Menne at Shekh abd-el-Gurnah, reproduced in Lyons, p. 500.

⁵ "Herodotus, Plato, Strabo, etc., ascribe the origin of geometry to changes which annually took place from the inundation, and to the consequent necessity of adjusting the claims of each person respecting the limits of the lands."—Quoted from Wilkinson, IV, 6.

After about 3000 B.C. a register of the lands seems to have been kept with the owner's name, area, position, tax due, etc. Duplicate copies were sometimes filed in the granary and in the treasury.¹ Rameses, in narrating his good deeds in the Great Abydos inscription, says: "I have made for thee calculations of the fields."²

In the Twelfth Dynasty new and ambitious irrigation projects were conceived and carried out. The Fayum, a great natural depression in the Libyan Desert, was utilized as a reservoir, and canals of inflow and outflow were constructed through the gap in the hills which separated it from the Nile. This added greatly to the amount of water which might be conserved for later use. At the same time a part of the higher land within the Fayum was reclaimed by the building of enormous retention walls about it, and the tillable area of Egypt was thus considerably increased.

With the wealth of the country so dependent upon the annual flood, its height was always a matter of gravest concern. Too low a Nile—too little water—presaged a corresponding diminution in the harvest, while too high a Nile inevitably caused delay in planting and a shortened season for the maturing of the crops. The deposition of the rich sediment was also dependent upon the height of the flood and its consequent velocity;³ thus too high a Nile might carry much of it on to the sea, while with too low a river it might be dropped too soon and many acres deprived altogether of its benefits. The universal recognition of this dependence upon the height of the flood is shown in many of the early inscriptions. Thus Amenemhet in the Twelfth Dynasty says: ". . . . Then came Great Niles *possessors of grain and all good things.*"⁴ In an inscription of Rameses II, Ptah is thus represented as promising agricultural wealth:

I will give thee a great Nile, I endow for thee the Two Lands with wealth, produce, food, and luxuries, giving plenty in every place when thou tradest. I give to thee constant harvests, to feed the Two Lands at all times; the sheaves thereof are like the sand of the shore, their granaries approach heaven, and their grain heaps are like mountains.⁵

¹ Lyons, p. 499.

² Breasted, *Ancient Records of Egypt*, III, § 275.

³ P. E. Newberry and J. Garstang, *A Short History of Ancient Egypt* (Boston, 1904), p. 8.

⁴ Breasted, *Ancient Records of Egypt*, I, § 523.

⁵ *Ibid.*, III, No. 404.

The first indication of the inundation was carefully watched for at the cataracts, and news was at once sent to the king, as were also the records which were kept throughout its rising. The tomb of

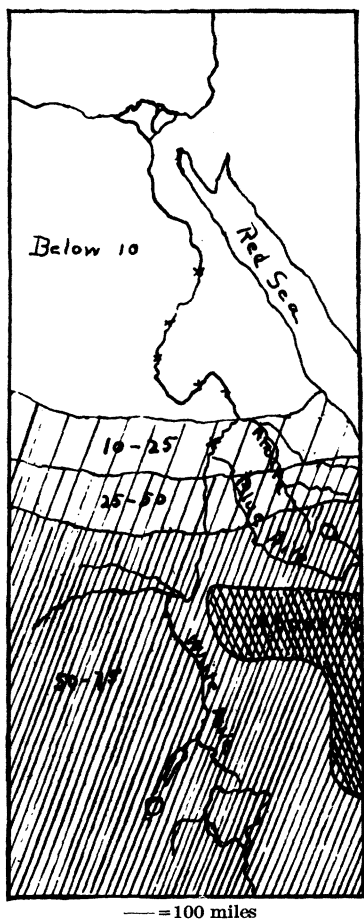


FIG. 2.—Map of Nile Valley showing annual rainfall in inches.
(x—cataracts)

Rekhmire of the Eighteenth Dynasty bears the inscription: "There shall be reported to him the high Nile."¹ By comparing these records with those of previous years the prospects for the coming harvest could be quite accurately foretold. From the data thus obtained the tax rate was fixed and the tax list made up.² The amount of grain which the government might export in any given year and the extent to which it was wise to embark upon large financial undertakings were also decided upon.

The maximum height of the flood was recorded upon the cataract rocks, which thus became Nilometers. Amenemhet III's instructions to his officials in the Fortress of Semneh date the establishment of a Nilometer at the Second Cataract. It is possible that the desire for a point of observation nearer the sources of the Nile may have been one of the factors which determined the conquest of that part of the valley.

The Nile flood was responsible for the division of the agricultural year into three seasons. The first, that of the inundation, began late in June and extended to the end of October; this was followed by the season of growing crops,

¹ Breasted, *Ancient Records of Egypt*, II, § 709.

² Breasted, *History of Egypt*, p. 239.

which lasted until late in February, and the remaining four months were given over to the harvest.¹ Sometimes, however, the harvest was delayed, possibly because the flood had been unusually high and the water had been slow in subsiding, and the gathering of the crops was barely completed before the inundation was upon them. Thus, in Paheri's tomb, an overseer is represented as calling to the laborers who are carrying wheat to the threshing-floor: "Hasten ye, quicken your feet; the water is coming and will soon reach your baskets."²

From inscriptions and paintings within the Egyptian tombs something can be gathered concerning the character of the crops and the prominence of stock-raising. In the tomb of Paheri, for instance, that prince is represented as "superintending the yearly stock-taking of herds,"³ and again as "counting the number of cattle."⁴ The animals are being driven toward him, four abreast—oxen, cows, calves, asses, goats, and swine—while he with papyrus, paintbox, and brush is noting their number. It is probable that the delta was the chief stock-raising region, inasmuch as it contained large areas of semi-swamp land, totally unfitted for cultivation, but yielding a rank growth of grasses. The undrained delta was extremely unhealthful for man, however, and as a consequence the native Egyptians did not act as herdsmen, but instead, impressed their Libyan captives into that service. Politically, this was far-reaching in effect, as it was one of the ways in which the Libyans obtained their foothold in the delta. Farther south, in Middle and Upper Egypt, domestic cattle were tended with great care. Yards and sheds were provided for them, and during the period of inundation they were taken to higher land. Branding was thus necessary, and in Paheri's tomb are several representations of the process.⁵ Vegetation grew rapidly after the water subsided, and it was only a short time until there was sufficient herbage so that the stock might again be turned out upon it.

Wheat and barley were the chief products of the field. They were gathered by reapers who cut the stalks with wooden sickles

¹ Baedeker, *op. cit.*, p. lxvii.

² *The Tomb of Paheri, op. cit.*, Plate V.

³ *Ibid.*, III, No. 404.

⁴ *Ibid.*, II, No. 709.

⁵ Breasted, *History of Egypt*, p. 239.

and bound them in sheaves. Sometimes the sheaves were carried directly to the granaries. These were large, more or less circular buildings, which were filled through an opening in the top.¹ At other times the grain was threshed by the treading of oxen and then winnowed by tossing it in the air with a pair of shovels. Near the Nile and on the borders of the canals, where water could at all times be obtained by the shaduf, succulent fruits and vegetables were raised, and on the marshy delta the papyrus was grown in great quantity.²

¹ For model of granary of Eleventh Dynasty see Naville's "XI Dynasty Temple at Deir El Bahari," *28th Memoir Egyptian Exploration Fund*, Plate IX.

² The writer is indebted to Professor George A. Barton, of Bryn Mawr College, for his advice in the preparation of this article.